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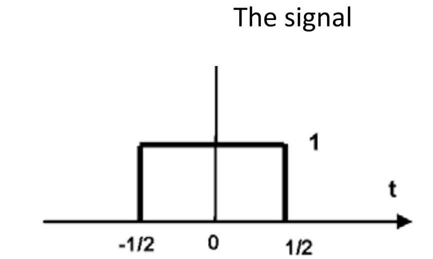
Fall 2010 – Final Exam **Signals & System (EE302)**Date: 18/01/2011 Time: 3hrs

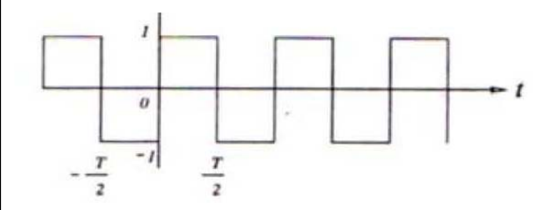
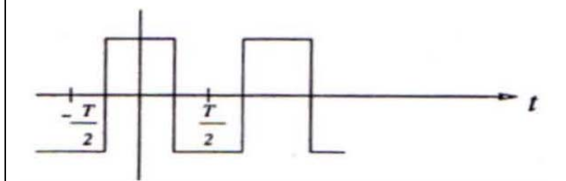
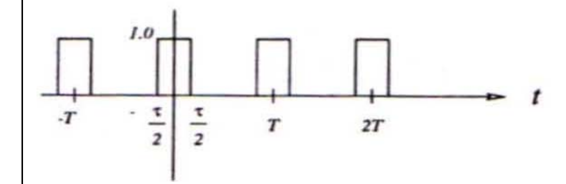
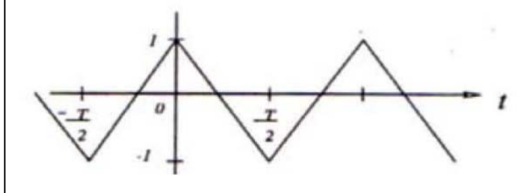
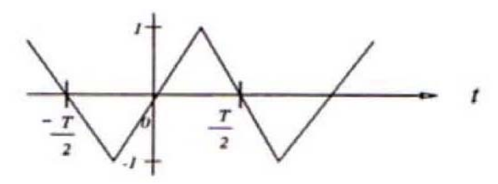
Instructors: Dr. Wael S. Abughres& Dr. Ali Ganoun

الاسم:................................ رقم القيد...........................

المجموعة.............



Mathematical form	The signal
$$\prod(t)=\begin{cases}1 & \lvert t\rvert<0.5\\ 1/2 & t=0.5\\ 0 & \lvert t\rvert>0.5\end{cases}$$	

The signal	Fourier Series
	$$\frac{4}{\pi}\sum_{n=1}^{\infty}\frac{1}{2n-1}sin\left[2\pi\frac{(2n-1)}{T}t\right]$$
	$$\frac{4}{\pi}\sum_{n=1}^{\infty}\frac{(-1)^{n+1}}{2n-1}cos\left[2\pi\frac{(2n-1)}{T}t\right]$$
	$$\frac{\tau}{T}+\frac{2\tau}{T}\sum_{n=1}^{\infty}\sin c\left(\frac{n\tau}{T}\right)\cos\left(2\pi\frac{n}{T}t\right)$$
	$$\frac{8}{\pi^2}\sum_{n=1}^{\infty}\frac{1}{(2n-1)^2}cos\left[2\pi\frac{(2n-1)}{T}t\right]$$
	$$\frac{8}{\pi^2}\sum_{n=1}^{\infty}\frac{(-1)^{n+1}}{(2n-1)^2}sin\left[2\pi\frac{(2n-1)}{T}t\right]$$

$$a_0=\frac{1}{T}\int_0^T f(t)dt \quad ,a_n=\frac{2}{T}\int_0^T f(t)\cos n\omega_0\,dt \quad , \quad b_n=\frac{2}{T}\int_0^T f(t)\sin n\omega_0\,dt \quad ,$$

$$y_k=U*h=\sum_{-\infty}^{\infty}U_j\{h_{k-j}\}$$

$$H(e^{j\theta})e^{jk\theta}[1+b_1e^{-j\theta}+\cdots+b_ne^{-jn\theta}]=e^{jk\theta}[a_0+a_1e^{-j\theta}+\cdots+a_me^{-jm\theta}]$$

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Answer the following questions

Q1)Choose the right answer: [8]

1) The Laplace Transform is used in the analysis of
   a) Continuous time systems b) analog systems c) any systems d) discrete time systems.

2)The term **BIBO** for stable systems means
   a) Binary Input Binary Output b)Binary Input Bounded Output
   c)Bounded Input Binary Outputd) Bounded Input Bounded Output

3)Analog signals
   a)are signals that is defined over a continuum of values of time.
   b)are defined at only a particular set of values of time.
   c)are signals for which both time and amplitude are discrete.

4)If the system is unstable, then its transfer function must have
   a)at least one pole in the left half of the S - plane .
   b)all of its poles and zeros in the left half of the S – plane.
   c) all of its poles in the right half of the S – plane.
   d)at least one pole in the right half of the S – plane.

5) A system is time-invariant if a time shift in the input signal causes a
   a) a time shift in the output signal b) a time shift in the input signal
   c) invertible system d) Noninvertible system

6) Many linear systems requirements are specified in terms of
   a) frequency response b) time-invariant characteristic c) time-variant characteristic

7) The Fourier transform of the unit impulse δ(t) is a) 1 b) 0 c) ∞ d) -1

8) The Laplace transform of the unit step u(t) is a) 1 b) 1/s c) 1/(s+1) d) s/(s+1)

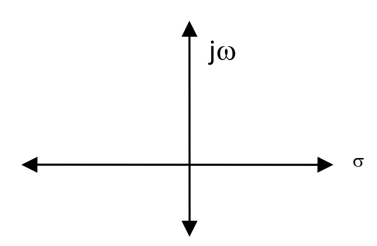
Q2) A system has the transfer function [6]

$$H(s) = \frac{s^3 + s^2 - 2s}{s^3 - 2s - 4}$$

a) Find & plot its poles in the S-plane
b) Find & plot its zeros in the S-plane
c) Is the system stable or unstable ?why?

Solution:

a) Poles : P1= P2= P3=
b) Zeros : Z1= Z2= Z3=
c) The systems is ……………….because …………………………..



Q3)Answer the following questions [6]

a) If the impulse response h(t) of a system is known, describe how to determine its frequency response H(f).

b) What is the result of convolving two identical signals $v(t) = \Pi(t)$ together?

Solution:

a)

b)

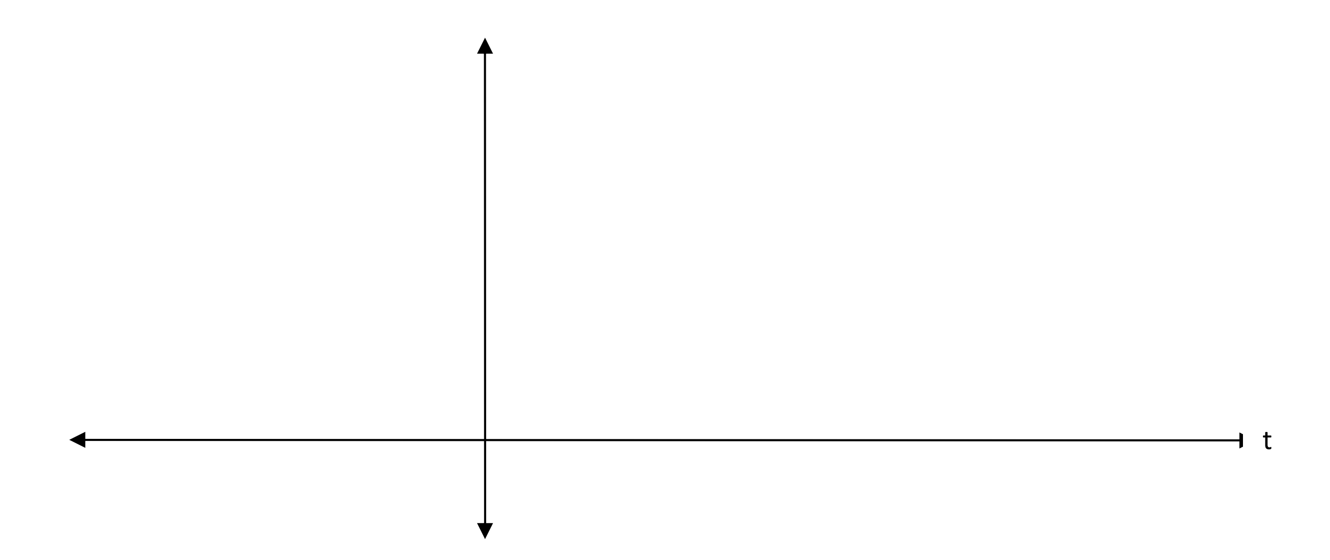
Answer any 5 questions from the following:

Q4)Given the following signal [6]

X(t)=5u(t+2)-2.5r(t+2)+2.5r(t)+3u(t)-1.5r(t-2)+1.5r(t-4)

Draw this signal

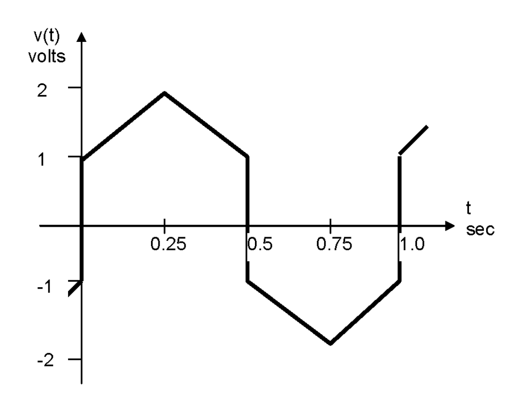
Solution:



Q5) **a)A periodic signal with a period T=4ms has odd symmetry** [6]

i. What is the value of the d.c component ?
ii. State which of the Fourier components have non-zero value.
iii. If the signal is discontinuous how many terms are required in the Fourier series to accurately represent the signal?

b) One cycle of a periodic signal is shown below. Determine the amplitudes of the first two non-zero Trigonometric Fourier coefficients



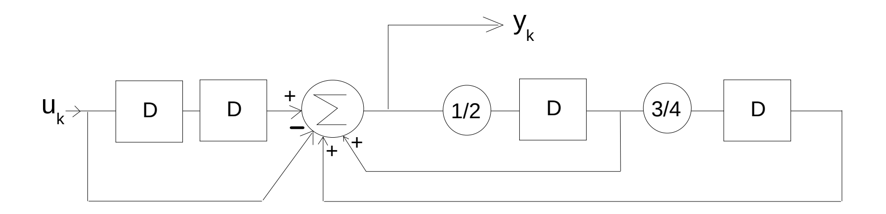
Solution:

a)

i.
ii.
iii.

b)

Q6) Find the frequency-response of the following discrete time system [6]



Solution

Q7) Find the impulse response of the continuous time systems defined by the following differential equation [6]

$$(D^2 - D - 6)\left[y(t)\right] = 5x(t)$$

Solution:

Q8) A discrete LTI system with input sequence $x(k)$ = {1} and output sequence $y(k)$= {0,0,1,-2,-3,1}. [6]

a) Find the impulse response of the system.
b) Find the output of the same system when $x(k)$= {-2,1}.

Solution

a)

b)

Q9) Sketch a block diagram of a system whose impulse response sequence is [6]

$$h_k = 36\left(\frac{1}{5}\right)^k - 30\left(\frac{1}{6}\right)^k \qquad k \ge 0$$

Solution

GOOD LUCK